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## Description

[0001] This invention relates to AC generators used for vehicles and, more particularly, to improvements to a rectifier unit installed therein. Advantageously, the rectifier unit includes a plurality of unidirectionally conducting devices, positive-electrode and negative-electrode side support members, a circuit board, and sections related to the rectifier unit.

[0002] The United States patent US-A-3,160,771 discloses an AC generator comprising a rotor journaled on a rotary shaft and a rectifier unit arranged substantially perpendicular thereto. The rectifier comprises first and second diodes disposed on the surface of two circular support members and means for interconnecting the first and second diodes which are disposed opposite one another.

[0003] The French patent FR-A 2 026 597 discloses a generator in which first and second diodes are arranged opposite one another on the circumference of a support plate. The single support plate is arranged perpendicular to the rotor of the generator.

[0004] The German laid-open patent publication DE-A 2 228 856 discloses rectifier elements mounted to one side of an insulator plate. The rectifier elements are electrically interconnected by means of buses passing through the insulating plate, which is circular and arranged perpendicular to the generator rotor.

[0005] The published Japanese patent application JP-A 61-180556 discloses a rectifier for an AC generator in which two cooling fins of approximately semi-circular shape are arranged opposed to one another and separated by an insulating bush. The cooling fins serve as support plates for rectifier elements arranged along the circular arc thereof.

[0006] Fig. 24 is a sectional view illustrating a conventional vehicle AC generator, Figs. 25 and 29 are circuit diagrams of prior art AC generators, Fig. 26 is a perspective view of the rectifier unit of the generator of Fig. 24, Fig. 27 is a bottom view of the rectifier unit shown in Fig. 26, and Fig. 28 is an exploded view for describing the assembly procedure of the armature and rectifier unit of Fig. 24.

[0007] According to Fig. 24, a conventional AC generator includes a front bracket 1, a rear bracket 2, and a rotary shaft 3. The shaft 3 is journaled through front and rear bearings 4a, 4b. Iron field cores 5a and 5b have a plurality of magnetic-pole claws at their outer circumferences and cylinder sections at their inner circumferences. The field cores 5a and 5b oppose each other in the axial direction with the claws interleaved and, with a coil 6, are attached on the rotary shaft.

[0008] Centrifugal cooling fans 7a and 7b are secured to the sides of the field cores 5a and 5b by spot welding. A current collector 8 is attached on the shaft 3 and is electrically connected to the coil 6. The current collector 8 rotates, together with the field cores, as a unit. An armature 9 has an iron core 9a and a coil 9b wound around

the core 9a. The ends of the armature coil 9b are provided with a connection terminal group 9c, as shown in Fig. 28, which extends from one end of the armature core 9a, and is formed in an L-shape.

[0009] As shown in Figs. 25 and 28, the terminal group 9c includes three-phase leads 9ca, 9cb, and 9cc, and, in certain cases, a neutral lead 9cn. The armature core 9a is clamped between the front and rear brackets 1, 2 and opposes the field cores 5a and 5b with a small clearance.

[0010] A voltage regulator 10 and rectifier unit 11 are included within the rear bracket. The rectifier unit 11 comprises a cooling plate 12 for the positive-electrode side, a cooling plate 13 for the negative-electrode side, diodes 14a for the positive-electrode side supported by the cooling plate 12, and diodes 14b for the negative-electrode side supported by the cooling plate 13.

[0011] The cooling plates 12 and 13 have a plurality of straight cooling fins 12a and 13a which extend both perpendicular to and in parallel with the shaft 3, as shown in Figs. 24, 26 and 27.

[0012] The surfaces of the cooling plates 12 and 13, which are disposed parallel to the rotary shaft 3, have rectangular holes 12b and 13b (see Fig. 27) for mounting diodes 14a, 14b on the surfaces opposing the surfaces on which the cooling fins 12a and 13a are provided. The planar base electrodes of the diodes 14a and 14b are connected to the rectangular holes at a predetermined interval by soldering. The cooling plates 12 and 13 are combined such that the rear surfaces of the diodes 14a and 14b oppose each other diagonally. Pairs of the leads 14al and 14bl of the diodes 14a and 14b extend in parallel to the shaft 3 as shown in Fig. 24 and Fig. 26, together with the connection terminals 16a of a circuit board 16, described later, and are soldered to the leads 9ca through 9cc and 9cn of the terminal group 9c of the armature coil 9b introduced by the guide 17a (see Fig. 28) of a partition plate 17, also described later.

[0013] The four diodes 14a have anode leads 14al and planar electrode cathodes, and are constructed using a resin-molded type package, as are the four diodes 14b. The diodes 14a and 14b are soldered to the cooling plates 12 and 13 in common, with their cathodes and anodes connected as shown in Figs. 25 and 27.

[0014] A cylindrical molded insulator 15, having a flange, is placed between the cooling plates 12 and 13 and insulates the plates, and the circuit board 16. The circuit board 16 serves as a junction for electrically connecting the armature coil 9b, the voltage regulator 10, the diodes 14a, and the diodes 14b. Connection sections 16b and 16c (see Figs. 25 and 26) for connecting to the voltage regulator 10 are soldered with connection lines from the voltage regulator 10. The rectifier unit 11 comprises the cooling plates 12 and 13, and the circuit board 16, which are described above.

[0015] The partition plate 17 forms a blade opposing the cooling fan 7b in order to obtain the needed amount of cooling air from the fan.

[0016] The armature 9 is assembled as follows: After the rectifier unit 11 is mounted on the rear bracket 2 together with other components, the connection terminal group 9c of the armature coil, formed in an L-shape in advance to align with the guide 17a, as shown in Fig. 28, is installed and the terminals are soldered to the leads 14al and 14bl from the inner peripheral side of the armature. Then, the field cores 5a and 5b, attached on the shaft 3, are inserted into the armature.

[0017] It will be noted that when an armature is used in which the terminals of the coil 9b have no lead 9cn, as shown in Fig. 29, one of the connection terminals 16a of the circuit board 16, corresponding to the lead 9cn shown in Fig. 28, is not used. Therefore, diodes 14a and 14b corresponding to the lead 9cn are not required.

[0018] The generator is driven by an engine, not shown in the figures, through a pulley to generate three-phase electric power at the coil 9b by rotating shaft 3 and the iron field cores 5a and 5b. The rectifier unit 11 performs three-phase full-wave rectification of the AC current generated in coil 9b and supplies the current to loads, as shown in Fig. 25.

[0019] The cooling fan 7b rotates together with the iron field core 5b. Outside air is drawn over cooling plates 12 and 13, diodes 14a and 14b, and coil 9b. The air is exhausted to the outside of the generator via the routes indicated by arrows A and B in Fig. 24.

[0020] The AC generator described above has the following problems.

a.) Since the planar electrodes of diodes 14a and 14b are arranged on planes parallel to shaft 3, as shown in Fig. 24, the generator is excessively long in the axial direction.

b.) Since the surfaces of cooling plates 12 and 13, on which diodes 14a or 14b are secured, are parallel to the shaft 3, outside air drawn in by cooling fan 7b does not flow smoothly in the routes indicated by the arrows A and B in Fig. 24. Therefore, the cooling efficiency of fins 12a and 13a is poor.

c.) The cooling capacity is also reduced since fins 12a and 13a are formed parallel to each other, creating portions in which air does not flow along the fins.

d.) Fin 13a, which is positioned at the outside surface, is arranged straight and parallel, forming a cube as shown in Fig. 27. Placing the rectifier unit in a rear bracket 2, having a small diameter causes the unit to protrude partially from the bracket. This restricts installation of the generator into a vehicle.

[0021] The invention was motivated by a desire to solve the above-described problems. It is an object of the invention to provide an AC generator having a reduced axial length.

[0022] Another object of the invention is to provide an AC generator having an improved cooling efficiency with respect to the rectifier unit.

[0023] A further object of the invention is to provide an AC generator having improved connectability between the armature coil and the rectifier unit.

[0024] According to the present invention, an AC generator is provided as defined in claim 1.

[0025] The AC generator further preferably includes a cooling fan rotating with the rotary shaft which draws air into the main unit of the generator. Cooling fins are attached to the support member opposite to the side on which the unidirectional conducting devices are supported. The casing member includes an indented section indented from the inside-out in the axial direction of the rotary shaft. The support member from which the cooling fins protrude is disposed within the indented section and that support member is secured to the casing member, thereby enabling the conduction of heat. The fan cools the fins.

[0026] Other objects and advantages of the present invention will become apparent from the detailed description of embodiments.

#### BRIEF DESCRIPTION OF THE DRAWINGS

[0027] Fig. 1 is a perspective view of a rectifier unit showing a first embodiment of the invention.

[0028] Fig. 2 is an elevation of the rectifier unit shown in Fig. 1, viewed from above, that is, from an armature.

[0029] Fig. 3 is a rear elevation of the rectifier unit shown in Fig. 1, viewed from below, that is, from a rear bracket.

[0030] Fig. 4 is a partial assembly view of the rectifier unit shown in Fig. 1.

[0031] Fig. 5 is a sectional view taken along the line V-V of Fig. 4.

[0032] Fig. 6 is an elevation of the cooling plate for the positive-electrode side of the rectifier unit shown in Fig. 1.

[0033] Fig. 7 is an elevation of the cooling plate for the negative-electrode side of the rectifier unit shown in Fig. 1.

[0034] Fig. 8 is an elevation of the circuit board of the rectifier unit shown in Fig. 1.

[0035] Fig. 9 is a sectional view taken along the line IX-IX of Fig. 8.

[0036] Fig. 10 is a sectional view of the main section of an AC generator according to the first embodiment of the invention.

[0037] Fig. 11 is a partial view of the AC generator of the embodiment shown in Fig. 10, viewed from the rear side, the left-hand side in the figure.

[0038] Fig. 12 is a sectional view of the main section of an AC generator according to a second embodiment of the invention.

[0039] Fig. 13 is an elevation of a part of a rectifier unit according to a third embodiment of the invention.

[0040] Figs. 14 and 15 are elevations of rectifier units according to the third embodiment of the invention, with modified shapes of the rectifying diodes.

[0041] Fig. 16 is a sectional view of the main section of a vehicle AC generator according to a fourth embodiment of the invention.

[0042] Fig. 17 is a plan illustrating the lead shape of a diode used in the embodiment shown in Fig. 16.

[0043] Fig. 18 is a plan illustrating a modified lead shape of a diode used in the fourth embodiment of the invention.

[0044] Fig. 19 is a sectional view of the main section of an AC generator according to a fifth embodiment of the invention.

[0045] Fig. 20 is an elevation illustrating a part of a rectifier unit according to the embodiment shown in Fig. 19.

[0046] Fig. 21 is a sectional view of the main section of an AC generator according to a sixth embodiment of the invention.

[0047] Fig. 22 is a sectional view of the main section of an AC generator according to a seventh another embodiment of the invention.

[0048] Fig. 23 is a sectional view of the main section of an AC generator according to an eighth embodiment of the invention.

[0049] Fig. 24 is a sectional view illustrating a conventional AC generator.

[0050] Fig. 25 is a circuit diagram illustrating an example of a circuit used in the conventional AC generator.

[0051] Fig. 26 is a perspective view of the rectifier unit of the conventional AC generator.

[0052] Fig. 27 is a bottom view of the rectifier unit shown in Fig. 26, viewed from below the figure.

[0053] Fig. 28 is a view for explaining the assembly procedure of the armature and the rectifier unit of the conventional AC generator.

[0054] Fig. 29 is a circuit diagram of another example of a circuit used in the conventional AC generator.

[0055] In all the figures, the same and the substantially same elements have similar reference numbers.

#### Embodiment 1

[0056] An embodiment of the invention will now be described while referring to Figs. 1 to 11. A rectifier unit 21 and a rear bracket 22 serve as a casing member. As shown in Fig. 10 and Fig. 11, the rear bracket 22 is provided with an indented section 22a in which the circular, cup-shaped center section is provided. A direct-mount section 22b, mounted to the outer peripheral section of the indented section, 22a, radially forms a unit with a cooling plate 33 (described later). Fins 22c have the same pitch angle as cooling fins 32b (described later) and serve to radiate heat. Section S of the fin, represented by the dashed line, has a mountain-like shape, as illustrated in Fig. 10.

[0057] Ellipse shaped vent holes 22d (see Fig. 11) are provided for indented section 22a, which extends in the rotary shaft direction. A total of 12 vent holes 22d exist, two of which are placed diametrically and six of which

are placed circumferentially. Between the fins 22c, located at the outer peripheral of section 22a, are vent holes 22e. The holes extend radially with respect to the rotary shaft 3. Vent holes 22g exist at the outermost section 22f of the rear bracket 22 and oppose connection terminal group 29c. Vent holes 22h exist at the outermost section 22f of the rear bracket 22 and oppose armature coil end 9b.

[0058] A first cooling plate 32, which is shaped like an arcuate-belt, serves as a support member and has a plane mounting surface 32a at one side, and cooling fins 32b, which protrude radially and toward rear end of the generator, at the other side. The first cooling plate 32 and the cooling fins 32b are integrally formed using die cast aluminum alloy. Three overlap-joint sections 32d having fixing holes 32e are placed in a circumferential direction of the first cooling plate 32. The sections and holes protrude radially outwardly and are aligned with a second cooling plate 33 along the rotary shaft 3, as shown in Figs. 4 and 6. Among the three fixing holes 32e, the center one is used as a B terminal connected to a battery through the rear bracket 22.

[0059] On the mounting surface 32a, four rectangular, indented holes 32c for mounting diodes (see Fig. 6), are formed radially to which diodes 34a (described later) are soldered.

[0060] The second cooling plate 33, made from die cast aluminum alloy, serves as a second support member and is shaped like an arcuate-belt. The second cooling plate 33 has a larger curvature than the first cooling plate 32. Therefore, one surface thereof serves as a mounting surface 33a and the other surface serves as a plane direct-mount surface 33b. The second cooling plate 33, as shown in Figs. 1 and 7, is provided with fixing holes 33e which are aligned with the overlap-joint sections 32d of the first cooling plate 32. On the mounting surface 33a, four rectangular indented holes 33c for mounting diodes (see Figs. 4 and 7) are formed radially, to which diodes 34b are soldered. The diode mounting holes 32c and 33c are indented in order to determine the position of the diodes 34a and 34b and to prevent solder from flowing out.

[0061] The second cooling plate 33 is arranged radially outward of the first cooling plate 32 with a certain radial clearance outside the first cooling plate 32. Mounting surfaces 32a and 33a are positioned on a surface perpendicular to the rotary shaft 3. The first cooling plate 32 is mounted in the indented section 22a of the rear bracket 22. The second cooling plate 33 is directly mounted such that the mounting surface 33b, the surface opposite of that on which the diode mounting holes 33c are provided, is mounted to the direct-mount section 22b of the rear bracket 22 with enough contact area for conducting heat (see Figs. 5 and 10). Each of the radial cooling fins 32b and 22c are arranged such that they are radially aligned.

[0062] The AC generator, according to this embodiment of the invention, uses the negative-electrode side

grounding method.

**[0063]** Diodes 34a and 34b serve as unidirectionally conducting devices for the positive-electrode and negative-electrode sides, respectively. Anode leads 34al serve as first connection conductors and cathode leads 34bl serve as second connection conductors. Both are extracted from the diode mold packages and are L-shape-bent at the ends as shown in Fig. 5. The diodes 34a and 34b are soldered to the diode mounting holes 32c and 33c of the first and second cooling plates 32 and 33 such that the leads 34al are diametrically opposed to the leads 34bl with a predetermined clearance. The base electrode surfaces of the diodes 34a and 34b have a good contact condition both electrically and thermally.

**[0064]** The first cooling plate 32 and the second cooling plate 33 side are overlapped at the fixing holes 32e and 33e, and insulated by a hollow, cylindrical mold insulator 35 (see Fig. 1) having a flange section at the middle. A circuit board 36 has an arcuate belt-shaped insulation support member 36d insert-molded with a insulation molding material as one unit, and is arranged such that four copper connection terminals 36a, having male threads as shown in Fig. 8, are nearly aligned with the leads 34al and 34bl of the diodes 34a and 34b. Reed sections 36e, serving as a third connection conductor, are connected to the leads 34al and 34bl and are L-shape bent as shown in Fig. 9.

**[0065]** The circuit board 36 is provided with connection sections 36b and 36c used for connecting the board to a voltage regulator, not shown in Figs. 1 - 11 (see the circuit diagram in Fig. 25). The connection section 36b electrically contacts the peripheral section of the fixing hole 32e on the surface of the cooling plate when the circuit board 36 overlaps the cooling plates 32 and 33 as shown in Fig. 1 and Fig. 2. The connection section 36c, together with the connection terminals 36a act as one conductive unit, as shown with a dashed line in Fig. 8. At the circular terminal portions of the connection sections 36b and 36c, male threads are formed as shown in Fig. 8.

**[0066]** The connection terminal group 29c is connected to the armature coil 9b with a junction terminal 29d as shown in Fig. 10, and is also connected to the rectifier unit 21 by tightening the junction terminal 29d to the connection terminal 36a of the circuit board 36 with a screw 37 in the axial direction of the rotary shaft 3.

**[0067]** The assembly procedure of the above-described vehicle generator will be described next. The diodes 34a and 34b are soldered to the first and second cooling plates 32 and 33 with high-temperature solder. Then, the second cooling plate 33 and the overlap-joint section 32d of the first cooling plate 32 are overlapped, with the mold insulator 35 being placed therebetween, and assembled to make a partially assembled product shown in Fig. 4 and Fig. 5. The circuit board 36 is placed on this partially assembled product with the mold insulator 35 being used as a guide, and the connection ter-

minals 36a are inserted between the anode leads 34al and the cathode leads 34bl of the diodes. Then, the anode leads 34al, the cathode leads 34bl, and the reeds 36e of the connection terminals 36a are combined by spot welding, or another method used to connect electrically (see Fig. 10), making the product shown in Fig. 1. The reeds 36e of the connection terminals 36a are spot-welded with the leads 34al and 34bl, which have an opening in the up and down direction of the figure, so as to be able to easily insert the electrodes of a spot welding machine, as shown in Fig. 9 and Fig. 10.

**[0068]** The rectifier unit 21, assembled as shown in Fig. 1, is inserted into the rear bracket 22 shown in Fig. 10 such that the first cooling plate 32 for the positive-electrode side is mounted in the indented section 22a of the bracket, and the second cooling plate 33 for the negative-electrode side is tightened to the rear bracket 22 with a tightening bolt (not shown). It is inserted into the fixing holes 32e and 33e with the direct-connection surface 33b of the second cooling plate 33 butting against the direct connection section 22b of the bracket so that the mounting surface 33a sufficiently contacts with the direct-connection section 22b in order to conduct heat.

**[0069]** The armature 9 is arranged such that the coil winding is finished and the terminals of the connection terminal group 29c of the armature coil 9b are prepared. That is, the junction terminals 29d are connected by soldering to the terminals 29c using an arch shape piece protruding in parallel with shaft 3. The armature 9, to which the junction terminals 29d are connected, are combined with the rear bracket 22 in which the rectifier unit 21 is assembled, as shown in Fig. 10. The junction terminals 29d for the armature coil are tightened to the connection terminals 36a of the circuit board 36 with screws 37. Then, field iron cores 5a and 5b, attached over the rotary shaft 3, are inserted into the armature 9.

**[0070]** In the generator configured as described above, cooling air flows along the routes indicated by dotted lines and arrows C to F in Fig. 10. When a cooling fan 7b, serving as a centrifugal fan, draws air due to the rotation of the rotary shaft 3, air flows D and E are formed. Air flows D and E pass from the surroundings of the rotary shaft 3 to the inner surface of the cooling fan 7b through the fins 22c of the rear bracket, the vent hole 22e, and the cooling fins 32b of the first cooling plate 32. In the same way, air is drawn from the vent hole 22d in the axial direction along flow C. Air drawn from the vent hole 22g passes through the surroundings of the connection terminal group 29c along air flow F. The air cools the armature coil 9b and passes through the vent hole 22h.

**[0071]** Although a partitioning plate 17 has a shape slightly different from that of the conventional one shown in Fig. 24, it plays the same role.

**[0072]** In the AC generator, according to this embodiment, the mounting surfaces 32b and 33b of the first and second cooling plates 32 and 33, to which diodes

are to be mounted, are placed on the same plane perpendicular to the rotary shaft 3 as shown in Fig. 5 and Fig. 10. Diodes 34a and 34b are also placed on the same plane perpendicular to the rotary shaft. As a result, the axial length of the rectifier unit 21 and of the generator advantageously can be reduced.

[0073] Since the cooling fins 32b and fins 22c are radially arranged such that both fins diametrically overlap with the same pitch angles of the fins and cooling air flows as described above, cooling efficiency improves.

[0074] The second cooling plate 33 for the negative-electrode side is mainly cooled by the fins 22c located on the rear bracket 22. Other portions of the rear bracket 22 also contribute to heat radiation, increasing the cooling efficiency. In some cases, even if the fins 22c of the rear bracket 22 are removed, sufficient heat radiation can be obtained.

[0075] The circuit board 36, having insert-molded connection terminals 36a, can be connected to the junction terminals 29d in the axial direction of the rotary shaft 3 with screws 37, facilitating connection to the armature coil 9b without soldering, thus allowing the number of fabrication processes to be reduced.

#### Embodiment 2

[0076] Fig. 12 is a sectional view illustrating the main section of a vehicle AC generator according to a second embodiment of the invention. In Fig. 12, a well known heat-conductive silicone grease 39 is applied between the second cooling plate 33 for the negative-electrode side and the direct-connection section 22b of the rear bracket 22. With this silicone grease 39, a sufficient contact area is obtained, thereby improving heat-conductivity between the second cooling plate 33 and the rear bracket 22 and increasing the cooling efficiency of the diodes.

[0077] In the embodiment shown in Fig. 1, the contact surfaces of the second cooling plate 33 and the rear bracket 22 must be finished with substantial precision in order to provide a good path for heat conduction. Applying the silicone grease 39 between the second cooling plate 33 and bracket 22 ensures formation of a sufficient contact area providing good heat conductivity even if the respective contact surfaces have some protrusions and cavities. Other elastic materials such as types of silicone rubber having good heat conductivity may be used.

#### Embodiment 3

[0078] Fig. 13 is an elevation illustrating a part of a rectifier unit 21 according to a third embodiment of the invention. Each of diodes 44a, 44b, and a base electrode have a triangular shape at the tip and a pentagonal shape as a whole. The diodes 44a are radially mounted on the first cooling plate 32 for the positive-electrode side which is placed inside, as shown in Fig. 13. Since

the diodes 44a have a pentagonal shape, by cutting the bottom corners, a plurality of diodes 44a can be closely mounted. In the figure, however, the diodes are not closely mounted. The diodes 44b are not necessarily polygonal; they preferably have the same shape for reasons of compatibility and other factors.

[0079] As shown in Fig. 14 and Fig. 15, diodes 54a and 54b, having a pentagonal shape with an slightly larger apex angle than that illustrated in Fig. 13, or diodes 64a and 64b, having a hexagonal shape, may advantageously be used.

#### Embodiment 4

[0080] Fig. 16 is a sectional view illustrating the main section of the AC generator according to a fourth embodiment of the present invention. Fig. 17 is a diagram showing the shape of diode leads. In these figures, the leads 74al and 74bl of diodes 74a and 74b serve as first and second connection conductors. They are longer than leads 34al and 34bl used in the first embodiment shown in Fig. 5, and have claw-like terminals which can be tightened together with the junction terminals 29d of the armature coil 9b. The coil serves as a third connection conductor, with the screws 37 using the circuit board 36 as a junction.

[0081] In Fig. 18, which is a diagram illustrating another example of a lead shape, leads 84al and 84bl may have ring-shaped terminals. With use of these leads, leads 74al and 74bl and the junction terminals 29d of the armature coil 9b can be collectively tightened and connected to the terminals 36a of the circuit board 36, shown in Fig. 1, with the screws 37. Therefore, work corresponding to welding of the connection terminals 36a and leads 34al and 34bl in the embodiment shown in Fig. 1 can be eliminated.

#### Embodiment 5

[0082] Fig. 19 and Fig. 20 show a fifth embodiment of the invention. Fig. 19 is a sectional view illustrating the main section of the AC generator. Fig. 20 is an elevation illustrating a part of a rectifier unit. As shown in these figures, button-shaped diodes 94a and 94b have anode electrode plates and cathode electrode plates at both sides of the disk. One electrode plate is directly soldered to the first and second cooling plates 32 and 33, and the other electrode plate is soldered to leads 94al and 94bl. The leads 94al and 94bl and the lead sections 36e of the connection terminals 36a of the circuit board 36 can be connected by spot welding, similar to the embodiment shown in Fig. 1.

[0083] These button-shaped or disk-shaped diodes 94a and 94b can be mounted radially on the first cooling plate 32 with a short interval in the same way as in the embodiment shown in Figs. 13 - 15 due to their shape.

### Embodiment 6

[0084] In the embodiment shown in Fig. 1, the second cooling plate 33 is not provided with cooling fins, but, the rear bracket 22 is equipped with fins 22c. The second cooling plate 33 may be arranged such that it is provided with cooling fins and mounted in the rear bracket 22. Fig. 21 is a sectional view of the main section of the AC generator, showing a sixth embodiment. In Fig. 21, a hollow, cylindrical, rear bracket 102 has a bottom wall 102a. Vent holes 102b axially going through the bottom wall 102a and a vent hole 102c diametrically goes through the bracket 102 at the outer peripheral portion. The second cooling plate 133 is also provided with a plurality of protruded cooling fins 133b on the surface opposite the mounting surface 133a, for diodes 34b, and is mounted in the bracket 102 after being combined with the cooling plate 32.

[0085] The cooling fins 133b are arranged such that they are displaced radially with respect to the rotary shaft and overlap the cooling fins 32b. Cooling air caused by the cooling fan 7b flows in the same way as that for the embodiment shown in Fig. 16, which air efficiently cools the fins 133b and 32b.

### Embodiment 7

[0086] Fig. 22 is a sectional view of the main section of the AC generator according to a seventh embodiment of the invention. In Fig. 22, a rear bracket 202 has a plurality of radial fins 202b protruding from the bottom section 202a. Vent holes 202c, going through the rear bracket 202 axially, are provided between fins 202b and rotary shaft 3. A first cooling plate 232 is not equipped with cooling fins. The first and second cooling plates 232 and 33, assembled in advance, are mounted to the bracket 202 with sufficient contact areas so as to conduct heat efficiently. An insulation sheet 239, which has electrical insulating characteristics and is made from an insulation material having good heat conductivity, is placed between the first cooling plate 232 and the bracket 202. The second cooling plate 33 is directly mounted to the inside of the bottom section 202a of the bracket.

[0087] In this case, air flows through the outside of the rear bracket 202 to cool the fins 202b and then into the AC generator at the vent hole 202c, as shown by the dashed lines and arrows G and H in Fig. 22. The air is exhausted to the outside of the generator with the armature coil 9 being cooled in the same way as for the embodiment shown in Fig. 10.

### Embodiment 8

[0088] In the above-described embodiment, the bracket is used as a casing member. A cover may be provided in addition to the bracket, as a casing member. Fig. 23 is a sectional view of the main section of the AC generator, illustrating an eighth embodiment. In Fig. 23,

a hollow, cylindrical, rear bracket 302, mounted at the bottom, has vent holes 302a near the center for introducing air into the AC generator. The radial vent holes 302a are fan-shaped. A cover 340, serving as a casing member, is mounted to the rear bracket 302 and covers the first and second cooling plates 32 and 133, and the cooling fins 32b and 133b.

[0089] Air created by the cooling fan 7b, as shown by the dashed lines and arrows J and K in Fig. 23, flows into the inside of a cover 340 at a vent hole (not shown). The air then flows into the AC generator through the vent holes 302a of the rear bracket 302, and is exhausted to the outside of the AC generator, with the armature coil 9 being cooled in the same way as that for the embodiment shown in Fig. 10.

### Other Embodiments

[0090] In the above-described embodiments, the negative-electrode side is grounded. The positive-electrode side may be grounded with the diodes being connected in reverse polarity. In the disclosed embodiments, the cooling plates for the negative-electrode side are arranged diametrically to the cooling plate for the positive-electrode side. The positions of the cooling plates may also be reversed. Furthermore, in the embodiment shown in Fig. 1, protruding overlap-joint sections may be provided for the second cooling plate 33 in order to overlap, as opposed to being placed on, the first cooling plate 32.

[0091] The mounting surfaces 32a and 33a of the first and second cooling plates 32 and 33 are not necessarily planar. These mounting surfaces are required to be almost on the same plane perpendicular to the rotary shaft 3. They may be shifted to some extent, while not impeding the reduction in the length of the AC generator in the axial direction.

[0092] The radial cooling fins of the cooling plates and the fins of the rear bracket are provided as a preferable embodiment. They may be provided in other ways.

[0093] In the embodiment shown in Fig. 23, the first and second cooling plates 32 and 133 are provided with the cooling fins 32b and 133b, respectively. The fins may be placed on the cover 340 instead of the first and second cooling plates 32, 133. The cover and the cooling plates may be configured such that one plate is provided with fins (as shown in the embodiment of Fig. 1). The other cooling plate, not provided with fins, is mounted to the cover 340 ensuring good heat conductivity and heat radiation from the cover.

[0094] In the various embodiments, the diodes, having planar electrodes are soldered to the cooling plates. The diodes may be mounted with crimping. The diodes advantageously may be in canned-type, stud-type, or other packages. A rectifier unit can be configured without using metallurgical connection methods, ie., as soldering and welding, improving heat-resistance, if canned-type diodes are crimped after they have been



half-embedded in the cooling plates or when stud-type diodes are used.

[0095] Vehicle AC generators of this type usually have fans to cool the inside of the generator. However, even if cooling fans are not provided, the same effects can be obtained. Instead of cooling fans, a water cooling system, in which cooling water flows through the bracket, may be used. In a variation of Fig. 22, the rear bracket 202 may be provided with a water-cooling jacket, for example, instead of using the heat radiating fins 202b made on the rear bracket.

[0096] Even when an AC generator uses an almost-sealed water cooling system, or a sealed water cooling system, having inside cooling fans for stirring air, the embodiment shown in Fig. 21 or Fig. 23, for example, can be applied with a slight design modification.

### Claims

#### 1. A vehicle AC generator comprising:

a rotor disposed in a main unit and journaled on a rotary shaft (3),

a rectifier unit (21) for rectifying AC current, having a plurality of first and second unidirectionally conducting devices (34a, 34b), for positive electrode sides and negative electrode sides of the rectifier unit (21), respectively, means (36) for electrically interconnecting the first and second unidirectionally conducting devices (34a, 34b), and support members (32, 33) for supporting the first and second unidirectionally conducting devices (34a, 34b) so as to lie substantially on the same plane, which plane lies perpendicular to the rotary shaft (3),

a casing member (22, 340) enclosing at least one of the support members (32, 33),

characterized in that

said support members (32, 33) comprise first and second arcuate-belt shaped plates (32, 33) having different internal diameters, such that the first support plate (32) lies within the internal circumference of the second support plate (33) with the surface planes (32a, 33a) of the first and second plates (32, 33) lying substantially on said plane perpendicular to the rotary shaft (3),

wherein the first and second unidirectionally conducting devices (34a, 34b) are mounted on said surface planes (32a, 33a) of the first and second support plates (32, 33), respectively.

2. The generator according to claim 1, further comprising a cooling fan (7a, 7b) which rotates together with the rotary shaft (3) and thereby draws outside air into the inside of the main unit of the generator for cooling and cooling fins (32b, 133b) disposed on the respective support plates (32, 33) protruding from the sides opposed to surface planes (32a, 33a) on which the unidirectional conducting devices (34a, 34b) are mounted, wherein the cooling fan (7a, 7b) cools the cooling fins (32b, 133b).

3. The generator according to Claim 1, wherein the support members (32, 33) are secured to the casing member (22) such that both of the support members (32, 33) are capable of conducting heat and at least one of the support members (32, 33) is secured to the casing member (22, 202) with an electric insulation member (239) placed therebetween.

4. The generator according to Claim 3, further comprising a cooling fan (7a, 7b) which rotates together with the rotary shaft (3) and which draws outside air into the main unit of the generator for cooling; and heat-radiating fins (202b) disposed on the outside of the casing member (202) at position wherein the support members (32, 33) are secured to the inside of the casing member (202), wherein the cooling fan (7a, 7b) cools the heat-radiating fins (202b).

5. The generator according to Claim 1, further comprising a cooling fan (7a, 7b) which rotates together with the rotary shaft (3) and draws outside air into the inside of the main unit of the generator for cooling and protruded cooling fins (32b) disposed on the first support member (32), at the side opposed to the surface plane (32a) on which the first unidirectional conducting devices (34a) are supported, wherein the casing member (22) has a section (22a) expanded from the inside to the outside in the axial direction of the rotary shaft (3), wherein the one support member (32) from which the cooling fins (32b) protrude is located in the expanded section (22a) and the second support member (33) is secured to the casing member (22) so as to be able to conduct heat, and wherein the cooling fan (7a, 7b) cools the cooling fins (32b).

6. The generator according to Claim 5, wherein the casing member (22) supports heat-radiating fins (22c) located at an outside position on the casing opposite the position where the second support member (33) is secured, and wherein the cooling fan (7a, 7b) cools the cooling fins (32b) and the heat-radiating fins (22c).

7. The generator according to Claim 6, wherein the cooling fins (32b) and the heat-radiating fins (22c) are formed with the same pitch angle such that both



fins (32b, 22c) are arranged substantially radially with respect to the rotary shaft (3), the heat-radiating fins (22c) being arranged radially outwardly of the cooling fins (32b), and wherein through holes (22e) extending through the casing member (22) are provided between the heat-radiating fins (22c).

8. The generator according to any of Claims 2 and 4 to 7, wherein at least one of the cooling fins (32b) and the heat-radiating fins (22c) is formed substantially radially with respect to the rotary shaft (3).

9. The generator according to any of Claims 1 to 8, further comprising first connection conductors (34a) extending from the first unidirectionally conducting devices (34a) for the positive-electrode side and second connection conductors (34b) extending from the second unidirectionally conducting devices (34b) for the negative-electrode side and third connection conductors (36e) placed therebetween, wherein the first, second, and third connection conductors (34a, 34b, 36e) are electrically connected to one another.

10. The generator according to any of Claims 1 to 8, further comprising first connection conductors (34a) extending from the first unidirectionally conducting devices for the positive-electrode side which overlap in the axial direction of the rotary shaft (3) with second connection conductors (34b) extending from the second unidirectionally conducting devices for the negative-electrode side, and wherein the first and second connection conductors (34a, 34b) are electrically connected to third connection conductors (36e) with means for tightening the connection.

11. The generator according to Claim 10, further comprising a circuit board (36) having an insulation support member (36d) molded integrally with the third connection conductors (36e) using an electric insulation molding material, wherein the insulation support member (36d) is disposed so as to overlap at least one of the support members (32, 33) in the axial direction of the rotary shaft (3).

12. The generator according to any of Claims 1 to 11, wherein the casing member (22) comprises a bracket which journals the rotor.

13. The generator according to any of Claims 1 to 11, wherein the casing member comprises a cover (340) provided at the outside of a bracket which journals the rotor.

14. The generator according to any of Claims 1 to 13, wherein the first and second unidirectionally conducting devices (34a, 34b) are aligned in pairs

along radial lines from the rotary shaft (3) and wherein the first and second unidirectionally conducting devices (34a, 34b) are of non-rectangular, in particular circular shape.

15. The generator according to any of Claims 1 and 3 to 14, wherein at least one of the support members (32, 33) is secured to the casing member (22) with a heat-conductive elastic member (39) placed therebetween.

16. The generator according to any of Claims 1 to 15, wherein the first and the second support members (32, 33) are provided with overlap-joint sections (32d) which overlap the support members in the axial direction of the rotary shaft (3), and the support members (32, 33) being secured to one another by axially tightening the overlap-joint sections (32d) with tightening members.

17. The generator according to any of Claims 1 to 16, wherein the means (36) for electrically interconnecting the unidirectionally conducting devices (34a, 34b) comprise a circuit board (36) with electrical connectors (36a, 36b, 36c).

#### Patentansprüche

1. Fahrzeug-Wechselstromgenerator, der folgendes aufweist:

- einen Rotor, der in einer Haupteinheit angeordnet ist und der auf einer Drehwelle (3) gelagert ist,
- eine Gleichrichtereinheit (21) zum Gleichrichten von Wechselstrom, die eine Vielzahl von ersten und zweiten in einer Richtung leitfähigen Einrichtungen (34a, 34b) für positive Elektroden-seiten bzw. negative Elektroden-seiten der Gleichrichtereinheit (21), eine Einrichtung (36), um die ersten und zweiten in einer Richtung leitfähigen Einrichtungen (34a, 34b) elektrisch miteinander zu verbinden, sowie Halterungselemente (32, 33) aufweist, um die ersten und zweiten in einer Richtung leitfähigen Einrichtungen in einer derartigen Weise zu halten, daß diese im wesentlichen in derselben, zu der Drehwelle (3) senkrecht verlaufenden Ebene liegen,
- ein Gehäuseelement (22, 340), das wenigstens eines der Halterungselemente (22, 33) umschließt,

dadurch gekennzeichnet,

- daß die Halterungselemente (32, 33) eine erste und eine zweite bandbogenförmige Platte (32,

33) mit unterschiedlichem Innendurchmesser aufweisen, so daß die erste Halterungsplatte (32) innerhalb des Innenumfanges der zweiten Halterungsplatte (33) angeordnet ist, wobei die Oberflächenenebenen (32a, 33a) der ersten und der zweiten Platte (32, 33) im wesentlichen in der zu der Drehwelle (3) senkrechten Ebene liegen,

- wobei die ersten und zweiten in einer Richtung leitfähigen Einrichtungen (34a, 34b) auf der Oberflächebene (32a, 33a) der ersten bzw. der zweiten Halterungsplatte (32, 33) angebracht sind.

2. Generator nach Anspruch 1, weiterhin mit einem Kühlventilator (7a, 7b), der sich zusammen mit der Drehwelle (3) dreht und dadurch Außenluft in das Innere der Haupteinheit des Generators zur Kühlung einsaugt; und mit Kühlrippen (32b, 133b), die an den jeweiligen Halterungsplatten (32, 33) von den gegenüberliegenden Seiten der Oberflächenenebenen (32a, 32b) wegragend angeordnet sind, an denen die in einer Richtung leitfähigen Einrichtungen (34a, 34b) angebracht sind, wobei der Kühlventilator (7a, 7b) die Kühlrippen (32b, 133b) kühlt.

3. Generator nach Anspruch 1, wobei die Halterungselemente (32, 33) an dem Gehäuseelement (22) derart befestigt sind, daß beide Halterungselemente (32, 33) in der Lage sind, Wärme zu leiten, und wobei mindestens eines der Halterungselemente (32, 33) unter Zwischenanordnung eines elektrischen Isolierelements (239) an dem Gehäuseelement (22, 202) befestigt ist.

4. Generator nach Anspruch 3, weiterhin mit einem Kühlventilator (7a, 7b), der sich zusammen mit der Drehwelle (3) dreht und der Außenluft in die Haupteinheit des Generators hinein zur Kühlung einsaugt; und mit Wärmeabstrahlrippen (202b), die an der Außenseite des Gehäuseelements (202) an einer Stelle angeordnet sind, an der die Halterungselemente (32, 33) an der Innenseite des Gehäuseelements (202) befestigt sind, wobei der Kühlventilator (7a, 7b) die Wärmeabstrahlrippen (202b) kühlt.

5. Generator nach Anspruch 1, weiterhin mit einem Kühlventilator (7a, 7b), der sich zusammen mit der Drehwelle (3) dreht und Außenluft in das Innere der Haupteinheit des Generators zur Kühlung einsaugt; und mit wegragenden Kühlrippen (32b), die an dem ersten Halterungselement (32) auf der gegenüberliegenden Seite der Oberflächebene (32a) angeordnet sind, auf der die ersten in einer Rich-

tung leitfähigen Einrichtungen (34a) gehalten sind;

wobei das Gehäuseelement (22) einen Abschnitt (22a) aufweist, der in Axialrichtung der Drehwelle (3) von innen nach außen erweitert ist, wobei sich das eine Halterungselement (32), von dem die Kühlrippen (32b) wegragen, in dem erweiterten Abschnitt (22a) befindet und das zweite Halterungselement (33) an dem Gehäuseelement (22) derart befestigt ist, daß es in der Lage ist Wärme zu leiten, und wobei der Kühlventilator (7a, 7b) die Kühlrippen (32b) kühlt.

6. Generator nach Anspruch 5, wobei das Gehäuseelement (22) Wärmeabstrahlrippen (22c) trägt, die sich an einer außenseitigen Stelle an dem Gehäuse gegenüber der Stelle befinden, an der das zweite Halterungselement (33) befestigt ist, und wobei der Kühlventilator (7a, 7b) die Kühlrippen (32b) und die Wärmeabstrahlrippen (22c) kühlt.

7. Generator nach Anspruch 6, wobei die Kühlrippen (32b) und die Wärmeabstrahlrippen (22c) mit dem gleichen Teilungswinkel derart ausgebildet sind, daß beide Rippen (32b, 22c) in bezug auf die Drehwelle (3) im wesentlichen radial angeordnet sind, wobei die Wärmeabstrahlrippen (22c) radial außerhalb von den Kühlrippen (32b) angeordnet sind, und wobei sich durch das Gehäuseelement (22) hindurcherstreckende Durchgangsöffnungen (22e) zwischen den Wärmeabstrahlrippen (22c) vorgesehen sind.

8. Generator nach einem der Ansprüche 2 und 4 bis 7, wobei mindestens eine der Kühlrippen (32b) und der Wärmeabstrahlrippen (22c) in bezug auf die Drehwelle (3) im wesentlichen radial ausgebildet ist.

9. Generator nach einem der Ansprüche 1 bis 8, weiterhin mit ersten Anschlußleitern (34aI), die sich von den ersten in einer Richtung leitfähigen Einrichtungen (34a) für die Seite der positiven Elektrode wegerstrecken, und mit zweiten Anschlußleitern (34bI), die sich von den zweiten in einer Richtung leitfähigen Einrichtungen (34b) für die Seite der negativen Elektrode wegerstrecken, sowie mit dazwischen angeordneten dritten Anschlußleitern (36e), wobei die ersten, die zweiten und die dritten Anschlußleiter (34aI, 34bI, 36e) elektrisch miteinander verbunden sind.

10. Generator nach einem der Ansprüche 1 bis 8, weiterhin mit ersten Anschlußleitern (34aI), die sich von den ersten in einer Richtung leitfähigen Vorrichtungen (34a) für die Seite der positiven Elektrode

wegerstrecken und in Axialrichtung der Drehwelle (3) zweite Anschlußleiter (34bl) überlappen, die sich von den zweiten in einer Richtung leitfähigen Vorrichtungen für die Seite der negativen Elektrode wegerstrecken, und wobei die ersten und die zweiten Anschlußleiter (34al, 34bl) mit dritten Anschlußleitern (36e) mittels Einrichtungen zum Festziehen der Verbindung elektrisch verbunden sind.

11. Generator nach Anspruch 10, weiterhin mit einer Schaltungsplatte (36) mit einem Isolierungsträgerelement (36d), das unter Verwendung eines elektrisch isolierenden Formmaterials in integraler Weise an die dritten Anschlußleiter (36e) angeformt ist, wobei das Isolierungsträgerelement (36d) derart angeordnet ist, daß es wenigstens eines der Halterungselemente (32, 33) in Axialrichtung der Drehwelle (3) überlappt.
12. Generator nach einem der Ansprüche 1 bis 11, wobei das Gehäuseelement (22) einen Träger aufweist, an dem der Rotor gelagert ist.
13. Generator nach einem der Ansprüche 1 bis 11, wobei das Gehäuseelement eine Abdeckung (340) aufweist, die an der Außenseite eines Trägers vorgesehen ist, an dem der Rotor gelagert ist.
14. Generator nach einem der Ansprüche 1 bis 13, wobei die ersten und die zweiten in einer Richtung leitfähigen Einrichtungen (34a, 34b) paarweise entlang von Radiallinien von der Drehwelle (3) weg ausgerichtet sind, und wobei die ersten und die zweiten in einer Richtung leitfähigen Einrichtungen (34a, 34b) eine nicht rechteckige Formgebung, insbesondere eine kreisförmige Formgebung, aufweisen.
15. Generator nach einem der Ansprüche 1 und 3 bis 14, wobei wenigstens eines der Halterungselemente (32, 33) an dem Gehäuseelement (22) unter Zwischenanordnung eines wärmeleitenden elastischen Elements (39) befestigt ist.
16. Generator nach einem der Ansprüche 1 bis 15, wobei das erste und das zweite Halterungselement (32, 33) mit Überlappungsverbindungsabschnitten (32d) versehen sind, die die Halterungselemente in Axialrichtung der Drehwelle (3) überlappen, wobei die Halterungselemente (32, 33) durch axiales Festziehen der Überlappungsverbindungsabschnitte (32d) mittels Festzieheinrichtungen aneinander befestigt sind.
17. Generator nach einem der Ansprüche 1 bis 16, wobei die Einrichtung (36) zum elektrischen mitein-

ander Verbinden der in einer Richtung leitfähigen Einrichtungen (34a, 34b) eine Schaltungsplatte (36) mit elektrischen Verbindern (36a, 36b, 36c) aufweist.

## Revendications

### 1. Alternateur de véhicule comprenant:

un rotor disposé dans une unité principale et monté d'une manière tourillonante sur un arbre de rotation (3)  
une unité de redressement (21) pour redresser le courant alternatif, comportant une pluralité de premiers et de seconds dispositifs (34a, 34b) conducteurs unidirectionnellement pour les côtés d'électrode positifs et les côtés d'électrode négatifs de l'unité de redressement (21), respectivement, un moyen (36) pour interconnecter électriquement les premiers et seconds dispositifs conducteurs unidirectionnellement (34a, 34b), et des éléments de support (32, 33) pour supporter les premiers et seconds dispositifs conducteurs unidirectionnellement (34a, 34b) pour qu'ils se situent sensiblement sur le même plan, ce plan se situant perpendiculairement à l'arbre de rotation (3),  
un élément de boîtier (22, 340) renfermant au moins l'un des éléments de support (32, 33),

caractérisé en ce que

lesdits éléments de support (32, 33) comprennent des première et deuxième plaques (32, 33) configurées en courroies arquées qui ont des diamètres intérieurs différents de telle sorte que la première plaque de support (32) se situe dans la circonférence interne de la deuxième plaque de support (33), les plans de surface (32a, 33a) des première et seconde plaques (32, 33) se situant sensiblement sur ledit plan perpendiculaire à l'arbre de rotation (3), où les premiers et seconds dispositifs conducteurs unidirectionnellement (34a, 34b) sont montés sur lesdits plans de surface (32a, 33a) des première et seconde plaques de support (32, 33), respectivement.

2. Alternateur selon la revendication 1, comprenant en outre un ventilateur de refroidissement (7a, 7b) qui tourne ensemble avec l'arbre de rotation (3) et qui aspire ainsi l'air extérieur dans l'intérieur de l'unité principale de l'alternateur en vue du refroidissement, et des ailettes de refroidissement (32b, 133b) disposées sur les plaques de support respectives (32, 33) faisant saillie des côtés opposés aux plans de surface (32a, 33a) sur lesquels les dispositifs

conducteurs unidirectionnellement (34a, 34b) sont montés, où le ventilateur de refroidissement (7a, 7b) refroidit les ailettes de refroidissement (32b, 133b).

3. Alternateur selon la revendication 1, où les éléments de support (32, 33) sont fixés à l'élément de boîtier (22) de façon que les deux éléments de support (32, 33) soient aptes à conduire la chaleur, et au moins l'un des éléments de support (32, 33) est fixé à l'élément de boîtier (22, 202), avec un élément d'isolation électrique (239) placé entre ceux-ci.
4. Alternateur selon la revendication 3, comprenant en outre un ventilateur de refroidissement (7a, 7b) qui tourne ensemble avec l'arbre de rotation (3) et qui aspire l'air extérieur dans l'unité principale de l'alternateur en vue du refroidissement; et- des ailettes de rayonnement de chaleur (202b) disposées à l'extérieur de l'élément de boîtier (202) à une position où les éléments de support (32, 33) sont fixés à l'intérieur de l'élément de boîtier (202), où le ventilateur de refroidissement (7a, 7b) refroidit les ailettes faisant rayonner la chaleur (202b).
5. Alternateur selon la revendication 1, comprenant en outre un ventilateur de refroidissement (7a, 7b) qui tourne ensemble avec l'arbre de rotation (3) et qui aspire l'air extérieur dans l'intérieur de l'unité principale de l'alternateur en vue du refroidissement, et des ailettes de refroidissement saillantes (32b) disposées sur le premier élément de support (32), au côté opposé au plan de surface (32a) sur lequel les premiers dispositifs conducteurs unidirectionnellement (34a) sont supportés,
 

où l'élément de boîtier (22) a une section (22a) s'étendant de l'intérieur à l'extérieur dans la direction axiale de l'arbre de rotation (3), où un élément de support (32) à partir duquel les ailettes de refroidissement (32b) font saillie se situe dans la section étendue (22a), et le deuxième élément de support (33) est fixé à l'élément de boîtier (22) de manière à pouvoir conduire la chaleur, et où le ventilateur de refroidissement (7a, 7b) refroidit les ailettes de refroidissement (32b).
6. Alternateur selon la revendication 5, où l'élément de boîtier (22) supporte des ailettes (22c) faisant rayonner la chaleur situées à une position extérieure sur le boîtier opposé à la position où le second élément de support (33) est fixé, et où le ventilateur de refroidissement (7a, 7b) refroidit les ailettes de refroidissement (32b) et les ailettes (22c) faisant rayonner la chaleur.
7. Alternateur selon la revendication 6, où les ailettes de refroidissement (32b) et les ailettes (22c) faisant rayonner la chaleur présentent le même angle de pas de telle sorte que les deux ailettes (32b, 22c) sont agencées sensiblement radialement par rapport à l'arbre de rotation (3), les ailettes (22c) faisant rayonner la chaleur étant agencées radialement vers l'extérieur des ailettes de refroidissement (32b), et où des trous traversants (22e) s'étendant à travers l'élément de boîtier (22) sont ménagés entre les ailettes (22c) faisant rayonner la chaleur.
8. Alternateur selon l'une des revendications 2 et 4 à 7, où au moins l'une des ailettes de refroidissement (32b) et des ailettes (22c) faisant rayonner la chaleur est formée sensiblement radialement par rapport à l'arbre de rotation (3).
9. Alternateur selon l'une des revendications 1 à 8, comprenant en outre des premiers conducteurs de connexion (34a) s'étendant depuis les premiers dispositifs conducteurs unidirectionnellement (34a) pour le côté positif de l'électrode et des deuxièmes conducteurs de connexion (34b) s'étendant depuis les deuxièmes dispositifs unidirectionnellement conducteurs (34b) pour le côté négatif de l'électrode, et des troisièmes conducteurs de connexion (36e) placés entre ceux-ci, où les premiers, deuxièmes et troisièmes conducteurs de connexion (34a, 34b, 36e) sont reliés électriquement les uns aux autres.
10. Alternateur selon l'une des revendications 1 à 8, comprenant en outre des premiers conducteurs de connexion (34a) s'étendant depuis les premiers dispositifs unidirectionnellement conducteurs pour le côté positif de l'électrode qui se chevauchent dans la direction axiale de l'arbre de rotation (3) avec les deuxièmes conducteurs de connexion (34b) s'étendant depuis les deuxièmes dispositifs unidirectionnellement conducteurs pour le côté négatif de l'électrode, et où les premier et deuxième conducteurs de connexion (34a, 34b) sont reliés électriquement à des troisièmes conducteurs de connexion (36e) avec des moyens pour serrer la connexion.
11. Alternateur selon la revendication 10, comprenant en outre une plaquette à circuits imprimés (36) ayant un élément de support d'isolation (36d) moulé intégralement avec les troisièmes conducteurs de connexion (36e) en utilisant un matériau de moulage d'isolation électrique, où l'élément de support d'isolation (36d) est disposé de manière à se chevaucher à au moins l'un des éléments de support (32, 33) dans la direction axiale de l'arbre de rotation (3).
12. Alternateur selon l'une des revendications 1 à 11, où l'élément de boîtier (22) comprend un support sur lequel est monté d'une manière tourillonante le

rotor.

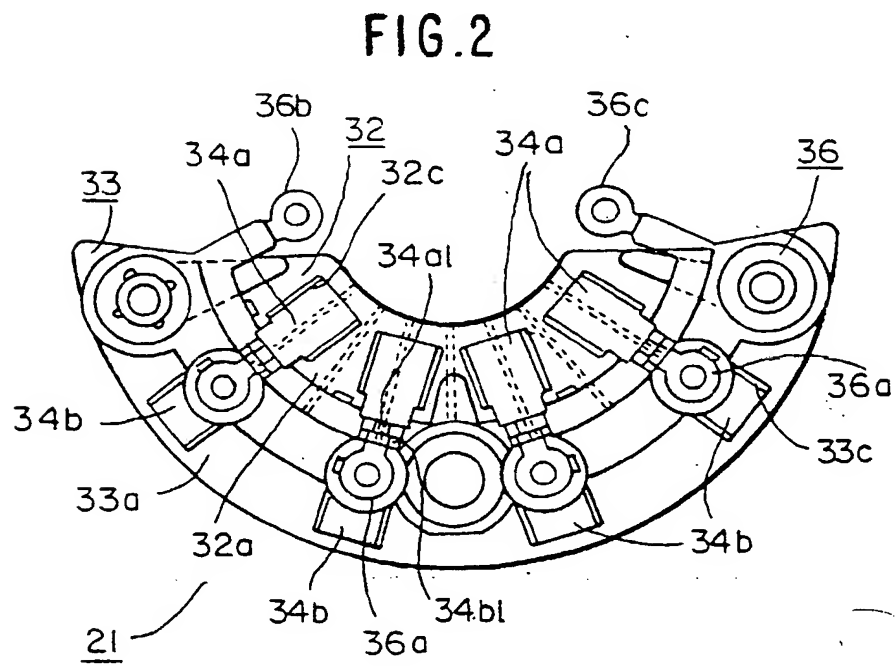
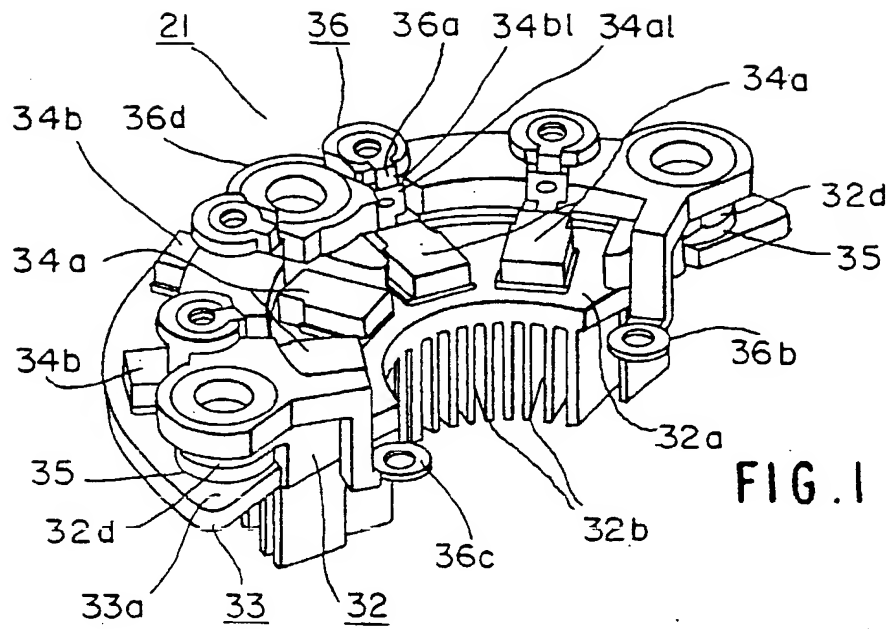
13. Alternateur selon l'une des revendications 1 à 11, où l'élément de boîtier comprend un couvercle (340) prévu à l'extérieur d'un support sur lequel est monté d'une manière tourillonante le rotor. 5
14. Alternateur selon l'une des revendications 1 à 13, où les premier et deuxième dispositifs unidirectionnellement conducteurs (34a, 34b) sont alignés par paires le long des lignes radiales depuis l'arbre de rotation (3), et où les premier et deuxième dispositifs unidirectionnellement conducteurs (34a, 34b) sont d'une forme non rectangulaire, en particulier circulaire. 10 15
15. Alternateur selon l'une des revendications 1 et 3 à 14, où au moins l'un des éléments de support (32, 33) est fixé à l'élément de boîtier (22), un élément élastique conducteur de chaleur (39) étant placé entre ceux-ci. 20
16. Alternateur selon l'une des revendications 1 à 15, où le premier et le deuxième élément de support (32, 33) présentent des sections de jonction à chevauchement (32d) qui chevauchent les éléments de support dans la direction axiale de l'arbre de rotation (3), et les éléments de support (32, 33) sont fixés l'un à l'autre en serrant axialement les sections de jonction à chevauchement (32d) avec des éléments de serrage. 25 30
17. Alternateur selon l'une des revendications 1 à 16, où le moyen (36) pour interconnecter électriquement les dispositifs unidirectionnellement conducteurs (34a, 34b) comprennent une plaquette à circuits imprimés (36) avec des connecteurs électriques (36a, 36b, 36c). 35

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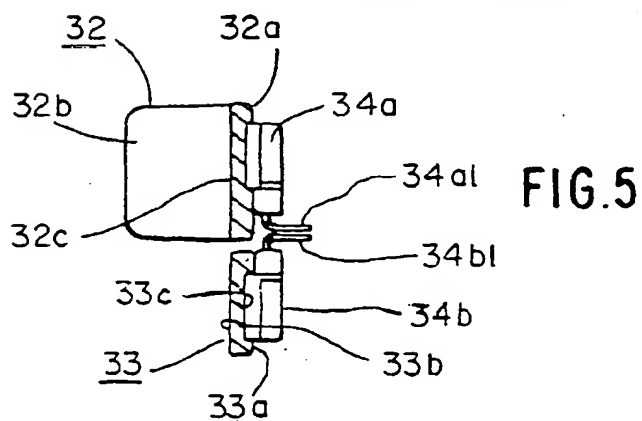
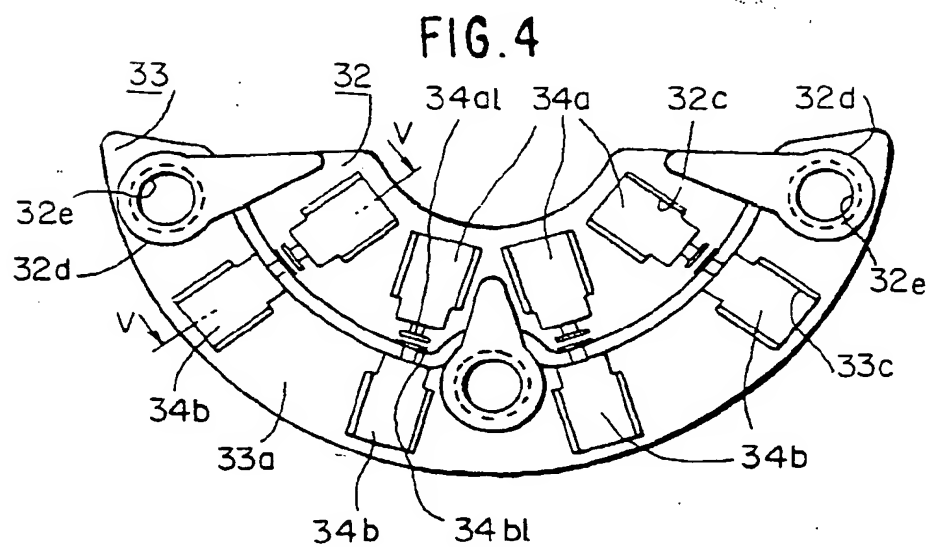
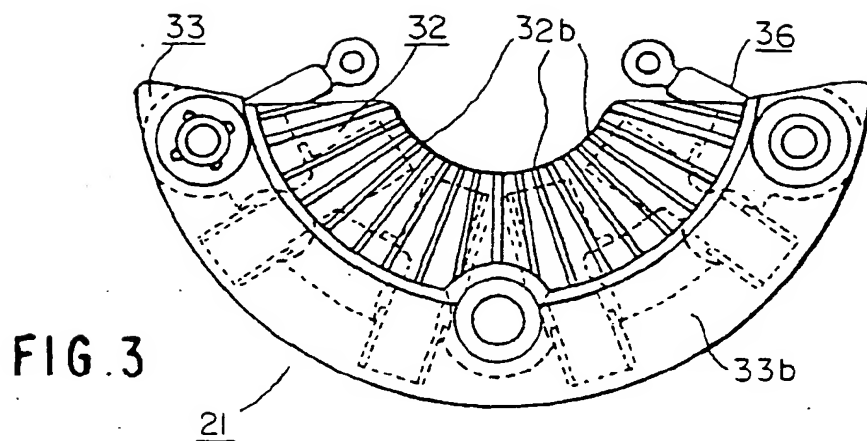




FIG.6

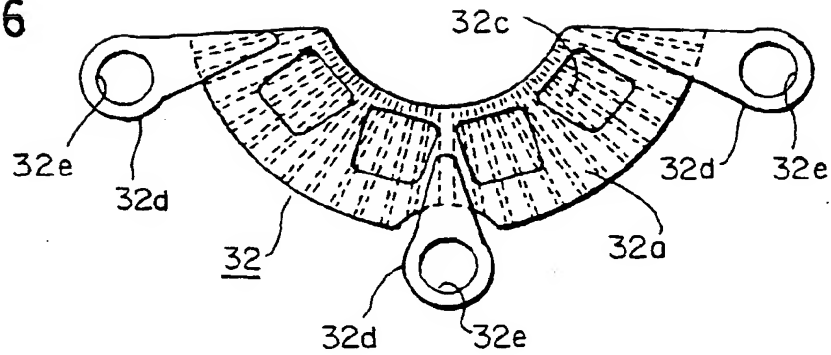


FIG.7

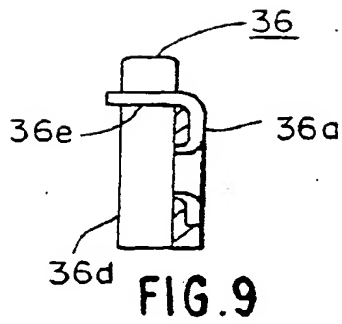
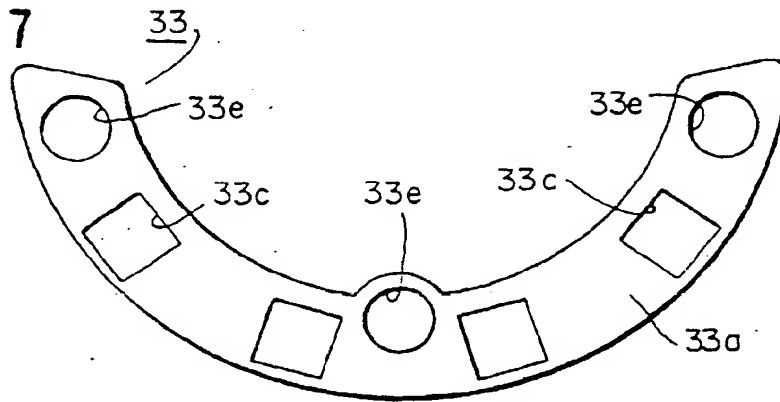
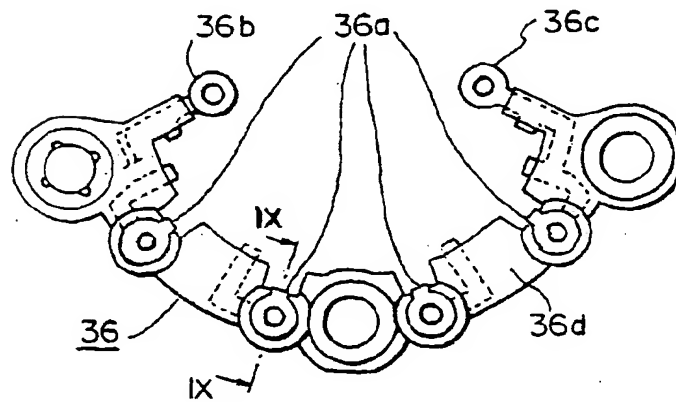


FIG.8



**FIG. 10**

FIG. 10 is a cross-sectional view of a mechanical assembly, likely a pump or valve, showing internal components and fluid flow paths. The diagram includes various labeled parts: 32b, 32, 34a1, 36, 3, 22, 17, 7b, 36a, 37, 29d, 22d, 22a, D, 22e, 34b1, S, E, 22c, 22b, 33, 29c, 22f, 22h, 9a, and 9b. Dashed lines indicate flow paths or internal structures, and arrows point to specific features like 22f and 22h.

[illegible]

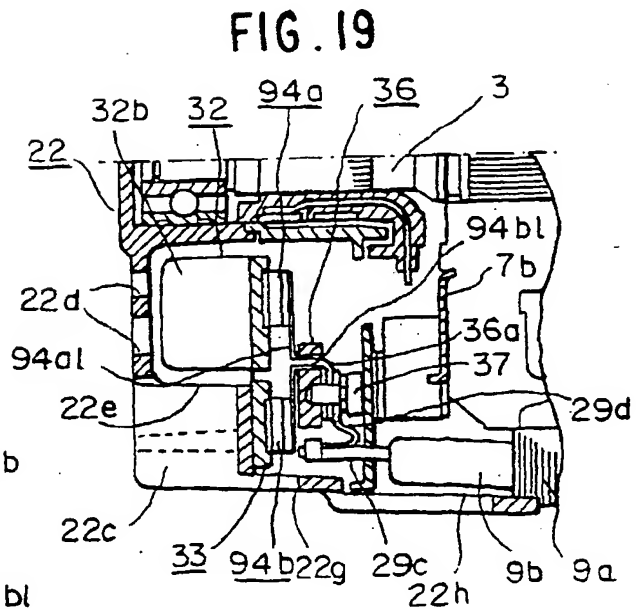
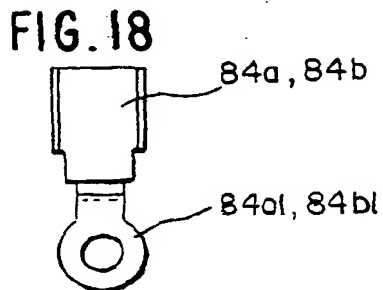
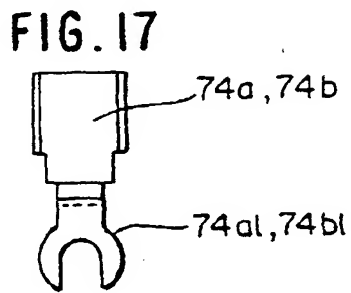
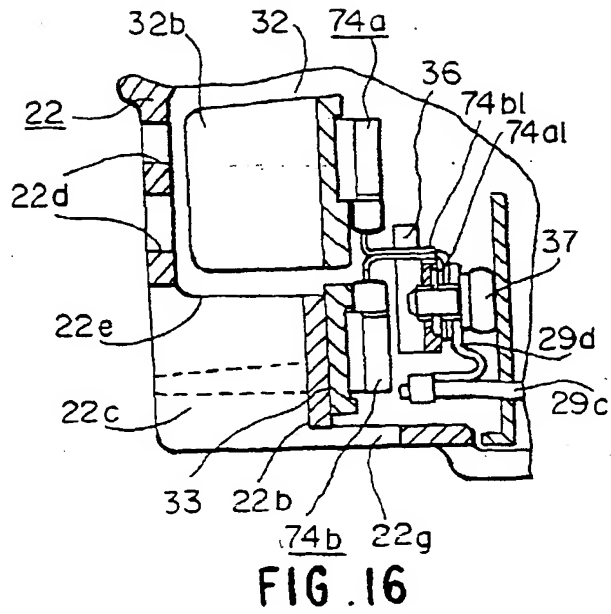
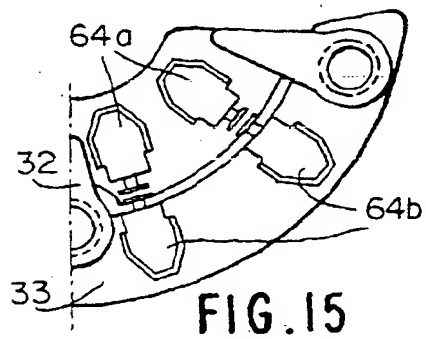
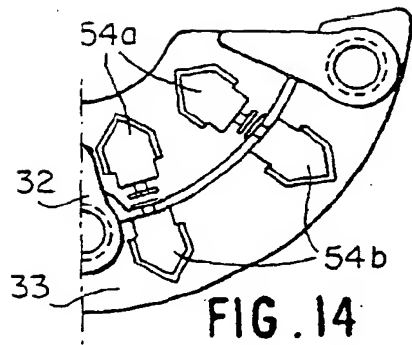


FIG. 20

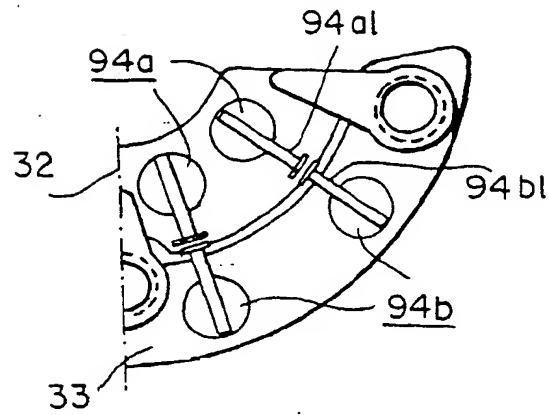
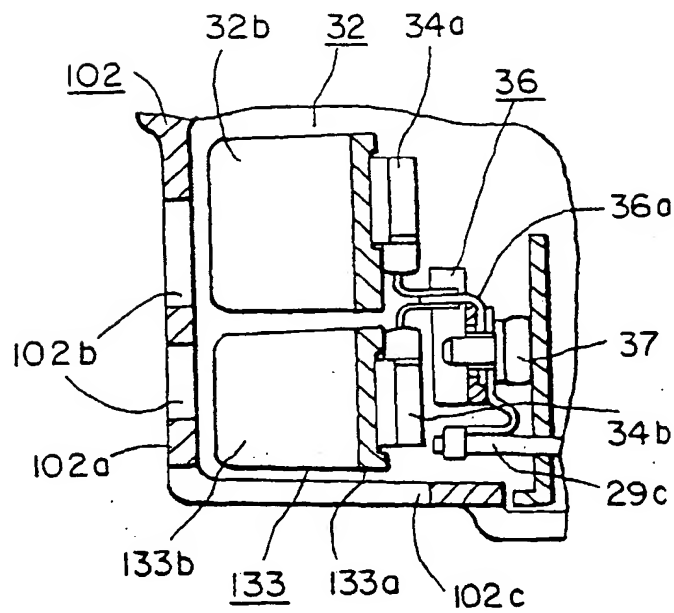
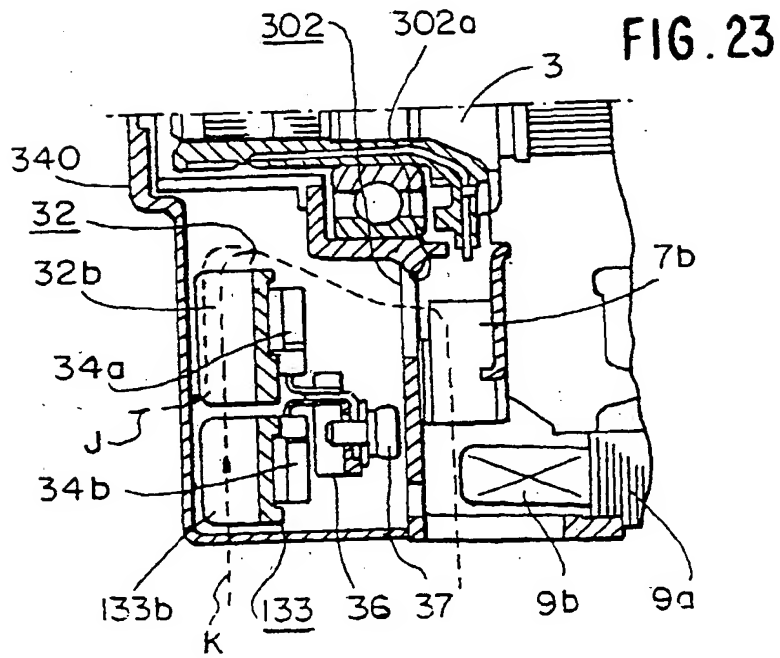
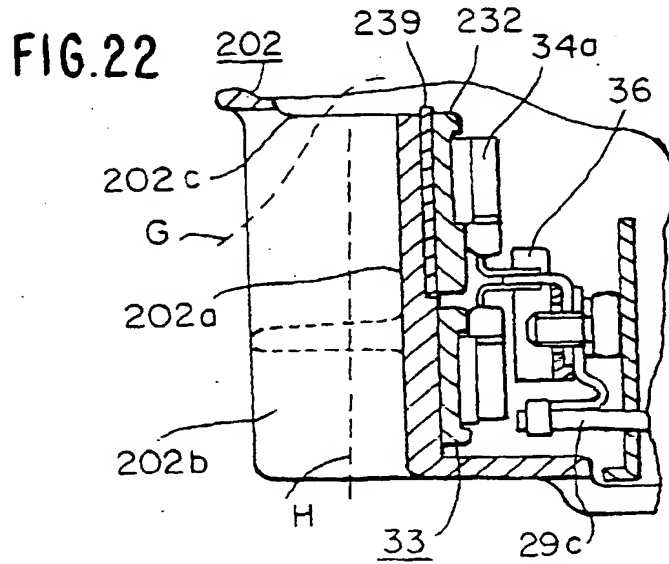


FIG. 21





**FIG. 24**  
PRIOR ART

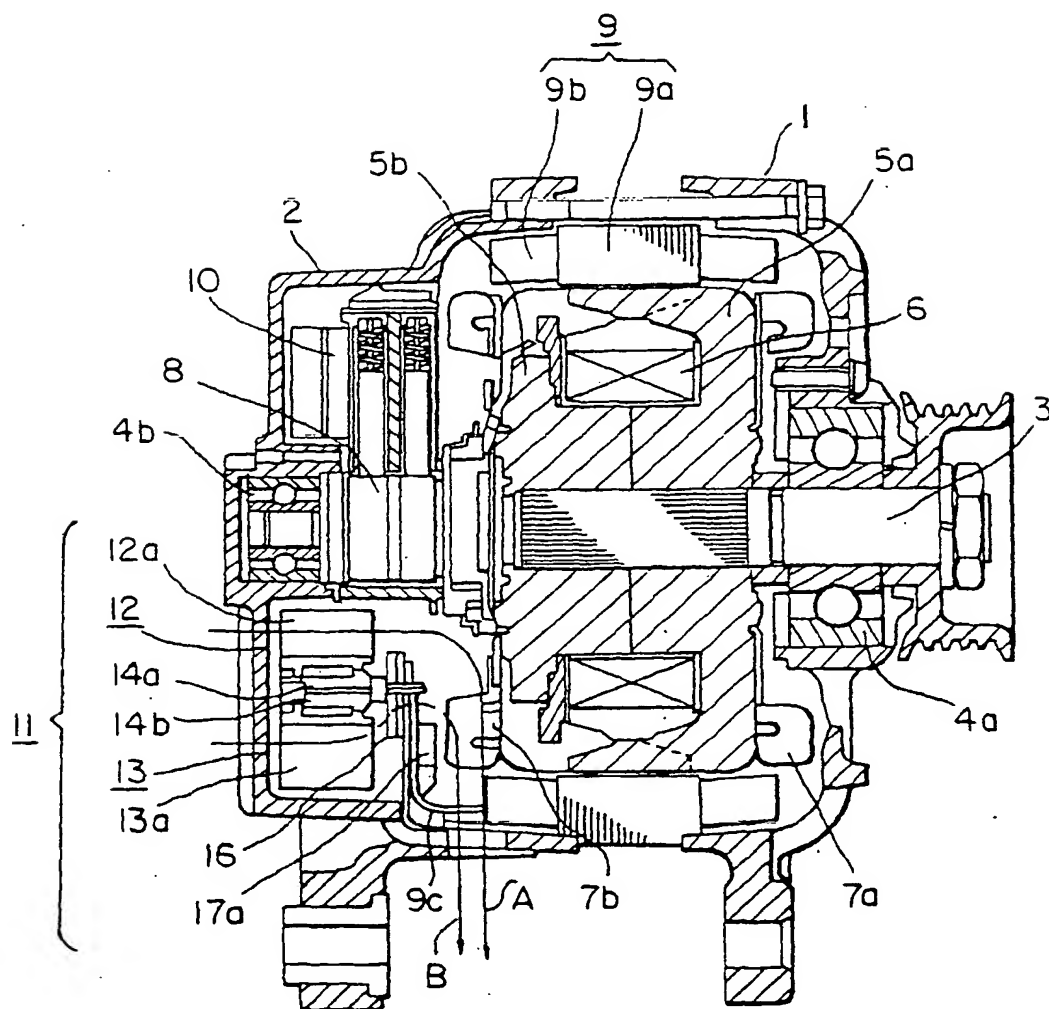


FIG.25 PRIOR ART

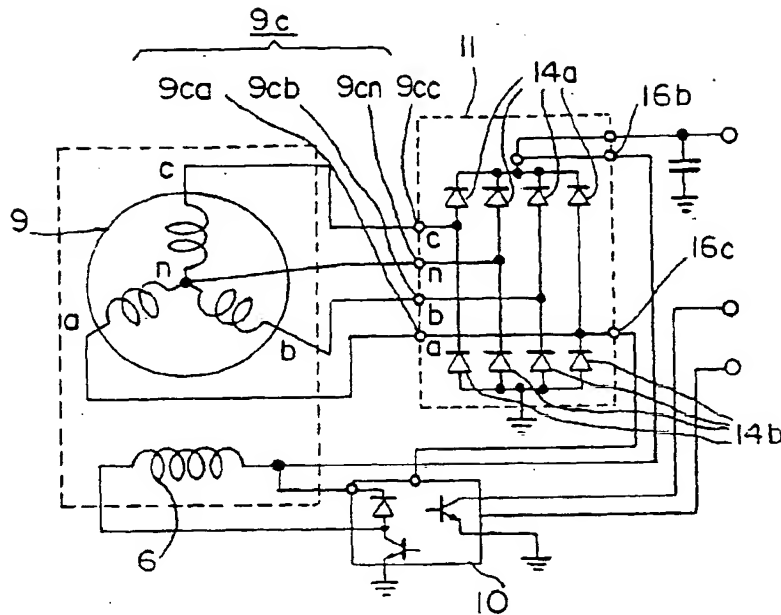
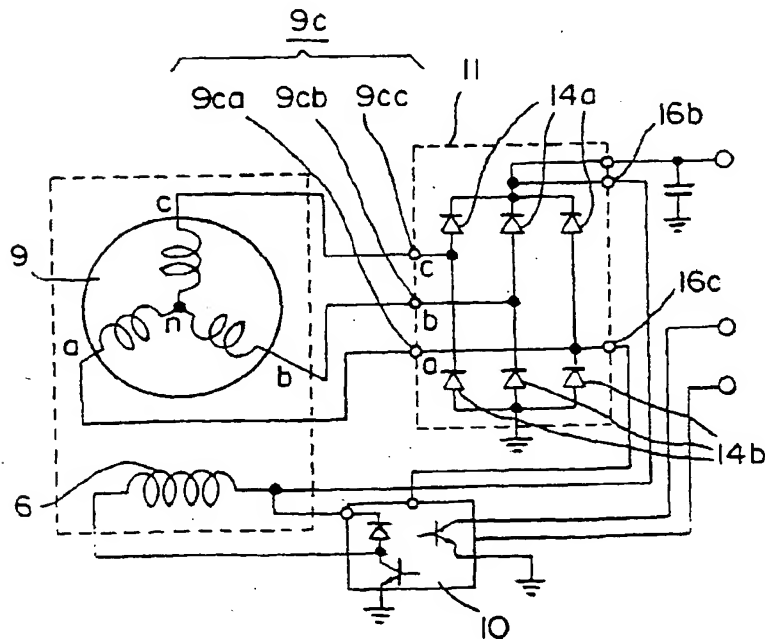
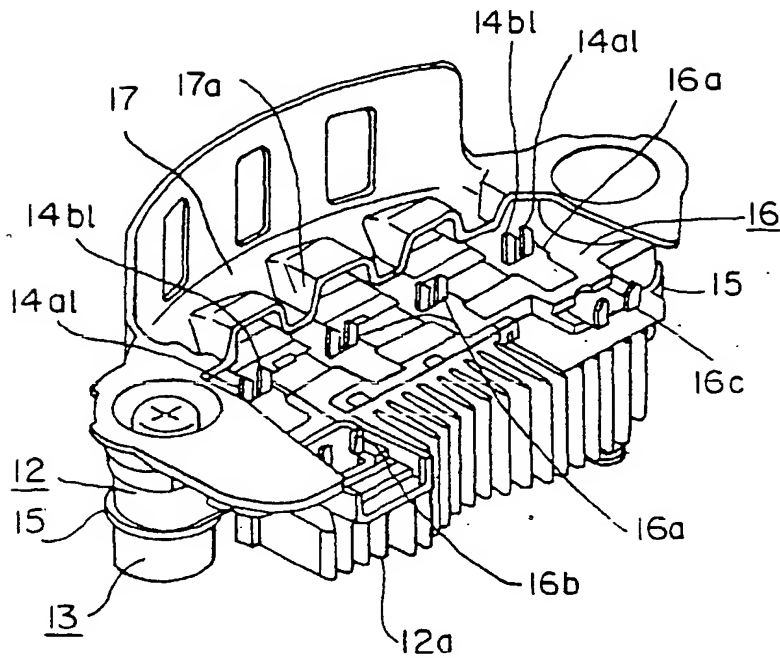


FIG.29 PRIOR ART





**FIG. 26** PRIOR ART



**FIG. 27** PRIOR ART

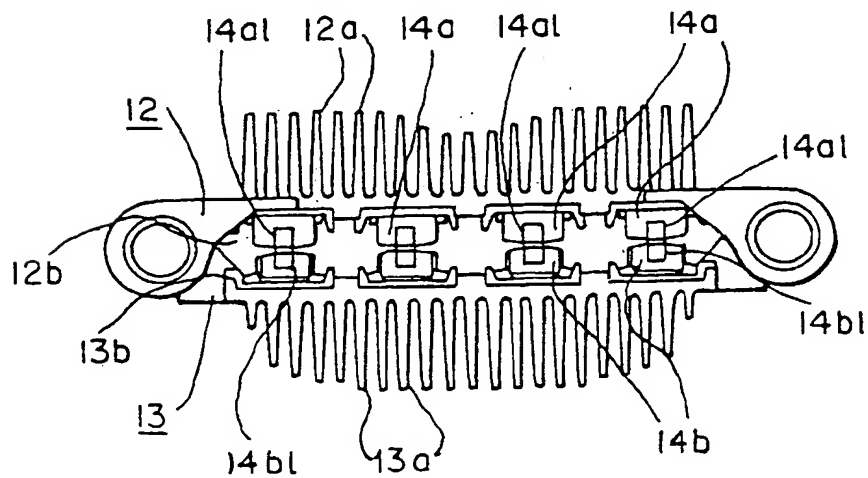


FIG. 28

